A predictive isotherm model was developed to evaluate the extent of bioregeneration of granular activated carbon loaded with phenol and 2,4-dichlorophenol (2,4-DCP). Two basic substrates (116 mg/l of phenol and 100 g/l 2,4-DCP) as single solute were prepared. The mixture of them was provided to bisolute system for assessing the competitive adsorption. The effect of by-products, which were generated during bio-degradation of substrate and measured as COD, on bioregeneration in the bisolute was investigated. Freundlich adsorption parameters ($K_{ads}$ and $1/n$) of 2,4-DCP were obviously higher than those of phenol in both single and bisolute. By-products in the bulk solution brought an adverse effect on adsorption capacity of GAC in all cases. By taking into account the by-product effect on adsorption, the Freundlich isotherms were used to formulate a predictive model of bioregeneration. Simulated results showed good consistency of observed results. Practical relevant of the proposed model for assessing of bioregeneration in the wastewater treatment was discussed by applying model to the BAC-SBR in the steady-state operation.